(19)日本国特許庁（ＪＰ）　(12)公開特許公報（Ａ）　(11)特許出願公開番号

特開平10－28282

(43)公開日　平成10年(1998)１月27日

(51)Int.Cl.*	識別記号	庁内整理番号	Ｆ Ｉ		技術表示箇所
Ｈ０４Ｑ　7/22			Ｈ０４Ｂ　7/26	１０７	
Ｈ０４Ｂ　7/26				Ｋ	
Ｈ０４Ｑ　7/38				Ｊ	
				１０９Ａ	

審査請求　未請求　請求項の数10　ＯＬ　（全 12 頁）

(21)出願番号　特願平8－183761

(22)出願日　平成８年(1996)７月12日

(71)出願人　392026693
エヌ・ティ・ティ移動通信網株式会社
東京都港区虎ノ門二丁目10番１号

(72)発明者　中村　武宏
東京都港区虎ノ門二丁目10番１号　エヌ・ティ・ティ移動通信網株式会社内

(72)発明者　佐藤　隆明
東京都港区虎ノ門二丁目10番１号　エヌ・ティ・ティ移動通信網株式会社内

(72)発明者　中野　悦宏
東京都港区虎ノ門二丁目10番１号　エヌ・ティ・ティ移動通信網株式会社内

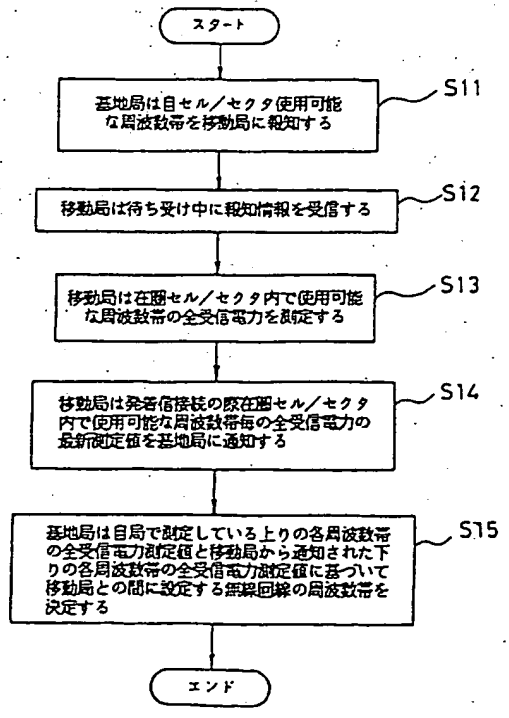
(74)代理人　弁理士　三好　秀和　（外３名）

(54)【発明の名称】　ＣＤＭＡ移動通信システムにおけるセル／セクタ判定および周波数選択方法および基地局装置と移動局装置

(57)【要約】

【課題】　セル／セクタによって使用可能な周波数帯が異なる場合でもセル／セクタの移行を適確に検出することができ、干渉電力を最小にし得る周波数帯を選択するＣＤＭＡ移動通信システムにおけるセル／セクタ判定および周波数選択方法および基地局装置と移動局装置を提供する。

【解決手段】　基地局は自セル／セクタで使用可能な周波数帯を移動局に報知し（ステップＳ１１）、移動局は待ち受け中に該報知情報を予め受信し、逐次在圏セル／セクタ内で使用可能周波数帯の全受信電力を測定し、発着信接続の際、在圏セル／セクタ内で使用可能な周波数帯毎の全受信電力の最新測定値を基地局に対して通知する（ステップＳ１２－Ｓ１４）。基地局は上りの各周波数帯の全受信電力測定値と通知された下りの各周波数帯の全受信電力測定値とから移動局との間に設定する無線回線の周波数帯を決定する（ステップＳ１５）。



【特許請求の範囲】

【請求項１】　基地局は配下のセル／セクタ内に在圏する移動局に対し、逐次、自セル／セクタおよびすべての隣接セル／セクタについてセル／セクタ毎の使用可能な周波数帯を報知し、
移動局は報知されたすべてのセル／セクタについてセル／セクタ毎に使用可能な周波数帯のうちの１周波数帯について在圏セル／セクタ判定用キャリアであるパイロットチャネルの希望波受信レベルを測定し、
この測定結果に基づいて在圏セル／セクタまたはセル／セクタ間の移行状況を判定することを特徴とするＣＤＭＡ移動通信システムにおけるセル／セクタ判定および周波数選択方法。

【請求項２】　基地局は配下のセル／セクタ内に在圏する移動局に対し、自セル／セクタで使用可能な周波数帯を報知し、
移動局は待ち受け中に前記報知情報を予め受信し、逐次在圏セル／セクタ内で使用可能な周波数帯の全受信電力を測定し、
移動局は発着信接続の際、在圏セル／セクタ内で使用可能な周波数帯毎の全受信電力の最新測定値を基地局に対して通知し、
基地局は自局で測定している上りの各周波数帯の全受信電力測定値および移動局から通知された下りの各周波数帯の全受信電力測定値を用いて、移動局との間に設定する無線回線の周波数帯を決定することを特徴とするＣＤＭＡ移動通信システムにおけるセル／セクタ判定および周波数選択方法。

【請求項３】　移動局はハンドオーバの起動を判定したときハンドオーバ元基地局から報知された隣接セル／セクタでの使用可能周波数帯の情報に基づき、ハンドオーバ先セル／セクタの各使用可能周波数毎に全受信電力を測定し、
該測定結果をハンドオーバ元基地局を介してハンドオーバ先基地局に通知し、
ハンドオーバ先基地局は自局で測定している上りの各周波数帯の全受信電力測定値および前記通知された各周波数帯毎の全受信電力測定値に基づいて無線回線を設定する周波数帯を決定することを特徴とするＣＤＭＡ移動通信システムにおけるセル／セクタ判定および周波数選択方法。

【請求項４】　基地局は配下のセル／セクタ内で通信している移動局に対し、すべての隣接セル／セクタについてセル／セクタ毎の使用可能な周波数帯を報知し、
移動局は前記報知されたすべての隣接セル／セクタについて隣接セル／セクタ毎に使用可能なすべての周波数帯の全受信電力を逐次測定し、該測定結果を基地局に通知しておき、
基地局は移動局のハンドオーバが起動されたときに、ハンドオーバ先基地局で使用可能なすべての周波数帯の全受信電力の最新測定値をハンドオーバ先基地局に対して通知し、
ハンドオーバ先基地局は自局で測定している上りの各周波数帯の全受信電力測定値および前記通知された各周波数帯毎の全受信電力測定値に基づいて無線回線を設定する周波数帯を決定することを特徴とするＣＤＭＡ移動通信システムにおけるセル／セクタ判定および周波数選択方法。

【請求項５】　前記無線回線を設定する周波数帯の前記決定において、上りおよび下りで全受信電力が最低である周波数帯が同一である場合には、該周波数帯とし、
上りおよび下りで全受信電力が最低である周波数帯が異なる場合には、上りおよび下りそれぞれで所定の値よりも小さい全受信電力を有する周波数帯のうち、上りについて全受信電力が最低である周波数帯を選択することを特徴とする請求項２ないし４のいずれかに記載のＣＤＭＡ移動通信システムにおけるセル／セクタ判定および周波数選択方法。

【請求項６】　基地局装置は、自セル／セクタおよびすべての隣接セル／セクタで使用可能な周波数帯をセル／セクタ毎に記憶する記憶手段と、自基地局の配下のセル／セクタ内に在圏する移動局に対し、逐次、自セル／セクタおよびすべての隣接セル／セクタについてセル／セクタ毎の使用可能な周波数帯を前記記憶手段から読み出して報知する報知手段とを有し、
移動局装置は、前記報知手段から報知された周波数帯をセル／セクタ毎に蓄積する蓄積手段と、該蓄積手段に蓄積された周波数帯のうちのセル／セクタ毎に１周波数帯についての希望波受信レベルをすべてのセル／セクタについて測定する測定手段と、この測定結果に基づいて在圏セル／セクタまたはセル／セクタ間の移行状況を判定する判定手段とを有することを特徴とするＣＤＭＡ移動通信システムにおける基地局装置と移動局装置。

【請求項７】　基地局装置は、自セル／セクタで使用可能な周波数帯を記憶する記憶手段と、自基地局の配下のセル／セクタ内に在圏する移動局に対し、自セル／セクタで使用可能な周波数帯を前記記憶手段から読み出して報知する報知手段とを有し、
移動局装置は、待ち受け中に前記報知情報を予め受信する受信手段と、該受信手段で受信した在圏セル／セクタで使用可能な周波数帯の全受信電力を逐次測定する測定手段と、発着信接続の際、在圏セル／セクタ内で使用可能な周波数帯毎の全受信電力の最新測定値を基地局に対して通知する通知手段とを有し、
基地局装置は、上りの各周波数帯の全受信電力を測定する測定手段と、該測定手段で測定した上りの各周波数帯の全受信電力測定値および前記通知手段により移動局から通知された下りの各周波数帯の全受信電力測定値を用いて、移動局との間に設定する無線回線の周波数帯を決定する周波数帯決定手段とを有することを特徴とするＣ

DMA移動通信システムにおける基地局装置と移動局装置。

【請求項8】　移動局装置は、ハンドオーバの起動を判定したときハンドオーバ元基地局から報知された隣接セル／セクタでの使用可能周波数帯の情報に基づき、ハンドオーバ先セル／セクタの各使用可能周波数毎に全受信電力を測定する測定手段と、該測定結果をハンドオーバ元基地局を介してハンドオーバ先基地局に通知する通知手段とを有し、

ハンドオーバ先基地局装置は、上りの各周波数帯の全受信電力を測定する測定手段と、前記通知手段から通知された各周波数帯毎の全受信電力測定値に基づいて無線回線を設定する周波数帯を決定する周波数帯決定手段とを有することを特徴とするCDMA移動通信システムにおける基地局装置と移動局装置。

【請求項9】　基地局装置は、すべての隣接セル／セクタについてセル／セクタ毎の使用可能な周波数帯を記憶する記憶手段と、自基地局の配下のセル／セクタ内で通信している移動局に対し、すべての隣接セル／セクタについてセル／セクタ毎の使用可能な周波数帯を前記記憶手段から読み出して報知する報知手段とを有し、

移動局装置は、前記報知手段から報知されたすべての隣接セル／セクタについて隣接セル／セクタ毎に使用可能なすべての周波数帯の全受信電力を逐次測定する測定手段と、該測定結果を基地局に通知する通知手段とを有し、

基地局装置は、移動局のハンドオーバが起動されたときに、ハンドオーバ先基地局で使用可能なすべての周波数帯の全受信電力の最新測定値を前記通知手段で通知された前記測定結果から取り出して、ハンドオーバ先基地局に対して報知する報知手段を有し、

ハンドオーバ先基地局装置は、上りの各周波数帯の全受信電力を測定する測定手段と、該測定手段で測定した測定値および前記報知手段で報知された各周波数帯毎の全受信電力測定値に基づいて無線回線を設定する周波数帯を決定する周波数帯決定手段とを有することを特徴とするCDMA移動通信システムにおける基地局装置と移動局装置。

【請求項10】　前記周波数帯決定手段は、上りおよび下りで全受信電力が最低である周波数帯が同一である場合には、該周波数帯を決定し、上りおよび下りで全受信電力が最低である周波数帯が異なる場合には、上りおよび下りそれぞれで所定の値よりも小さい全受信電力を有する周波数帯のうち、上りについて全受信電力が最低である周波数帯を決定する手段を有することを特徴とする請求項7ないし9のいずれかに記載のCDMA移動通信システムにおける基地局装置と移動局装置。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、符号分割多元接続（以下、CDMAと略称する）方式の移動通信システムにおいてセル／セクタによって使用可能な周波数帯が異なる場合においてセル／セクタの移行の判定および無線回線の周波数帯の選択を適確に行い得るCDMA移動通信システムにおけるセル／セクタ判定および周波数選択方法および基地局装置と移動局装置に関する。

【0002】

【従来の技術】従来のCDMAディジタル移動通信システムにおいては、すべてのセル／セクタで同じ複数の周波数帯を使用しており、すべてのセル／セクタにおいてすべての周波数帯に移動局のセル／セクタ判定用のキャリアであるパイロットチャネル、すなわち止まり木チャネルが配置されている。これにより、移動局は任意の周波数帯で隣接セルのパイロットチャネルの受信を行い、セル／セクタ判定を行うことができる。

【0003】しかしながら、加入者数の少ないエリアでは、システムの経済化を考慮し、配置する周波数帯を少なくする必要がある。このように経済化を考慮し、配置する周波数帯を少なくした場合には、セル／セクタによって使用可能な周波数帯が異なることになる。

【0004】従来のCDMA移動通信システムでは、移動局は各セル／セクタで使用不可能な周波数帯を認識していないため、移動局がセル／セクタ判定用に受信する周波数帯を移行先セル／セクタが配置していない状況が発生しうる。この場合、移行先セル／セクタにはその同じ周波数帯のパイロットチャネルが存在しないため、移動局はセル／セクタの移行を検出することができない。

【0005】一方、使用する無線回線の周波数帯は、無線回線品質上、上りおよび下りで干渉電力の最も小さい周波数帯とすべきである。上りの干渉電力量は基地局で常時測定できるが、下りの干渉電力量は移動局でしか測定できず、また移動局の位置によって異なり、時間とともに変動する。また、今後の移動通信サービスにおける報知情報サービス、例えば株式情報、天気予報、交通情報などの実現を考慮すると、上りと下りとで干渉電力量は非対称となることが考えられるため、下りの干渉電力の測定は必須である。従って、移動局において在圏セル／セクタで使用可能な周波数帯毎に下り干渉電力を測定する必要がある。ここで干渉電力は無線回線の設定前では全受信電力と考えることができる。

【0006】しかしながら、移動局は在圏セル／セクタで使用可能な周波数帯を認識していないため、周波数帯毎に全受信電力を測定することができない。このために、移動局は考えられ得るすべての周波数帯について全受信電力を測定すればよいが、これは使用していない周波数帯まで測定することになり、移動局の負荷を無意味に増大させることになる。

【0007】

【発明が解決しようとする課題】上述したように、従来のシステムでは、セル／セクタによって使用可能な周波

数帯が異なることにより、移動局がセル／セクタ判定用に受信する周波数帯が移行先セル／セクタに配置されていない場合、移動局はセル／セクタの移行を検出できないという問題がある。

【０００８】また、干渉電力の最も小さい周波数帯を選択するために、移動局においては在圏セル／セクタで使用可能な周波数帯毎に下り干渉電力、すなわち全受信電力を測定する必要があるが、移動局は在圏セル／セクタで使用可能な周波数帯を認識していないため、周波数帯毎に全受信電力を測定することができないという問題がある。

【０００９】また、このために、移動局は考えられ得るすべての周波数帯について全受信電力を測定すればよいが、これは使用していない周波数帯まで測定することになり、移動局の負荷を無意味に増大させることになるという問題がある。

【００１０】本発明は、上記に鑑みてなされたもので、その目的とするところは、セル／セクタによって使用可能な周波数帯が異なる場合でもセル／セクタの移行を適確に検出できるとともに、干渉電力を最小にし得る周波数帯を選択するＣＤＭＡ移動通信システムにおけるセル／セクタ判定および周波数選択方法および基地局装置と移動局装置を提供することにある。

【００１１】

【課題を解決するための手段】上記目的を達成するため、請求項１記載の本発明は、基地局は配下のセル／セクタ内に在圏する移動局に対し、逐次、自セル／セクタおよびすべての隣接セル／セクタについてセル／セクタ毎の使用可能な周波数帯を報知し、移動局は報知されたすべてのセル／セクタについてセル／セクタ毎に使用可能な周波数帯のうちの１周波数帯について希望波受信レベルを測定し、この測定結果に基づいて在圏セル／セクタまたはセル／セクタ間の移行状況を判定することを要旨とする。

【００１２】請求項１記載の本発明にあっては、基地局は移動局に自セル／セクタおよびすべての隣接セル／セクタで使用可能な周波数帯を報知し、移動局はセル／セクタ毎に使用可能な周波数帯のうちの１周波数帯についてパイロットチャネルの希望波受信レベルを測定し、該測定結果に基づいて在圏セル／セクタまたはセル／セクタ間の移行状況を判定する。

【００１３】また、請求項２記載の本発明は、基地局が配下のセル／セクタ内に在圏する移動局に対し、自セル／セクタで使用可能な周波数帯を報知し、移動局が待ち受け中に前記報知情報を予め受信し、逐次在圏セル／セクタ内で使用可能な周波数帯の全受信電力を測定し、移動局が発着信接続の際、在圏セル／セクタ内で使用可能な周波数帯毎の全受信電力の最新測定値を基地局に対して通知し、基地局が自局で測定している上りの各周波数帯の全受信電力測定値および移動局から通知された下りの各周波数帯の全受信電力測定値を用いて、移動局との間に設定する無線回線の周波数帯を決定することを要旨とする。

【００１４】請求項２記載の本発明にあっては、基地局は移動局に自セル／セクタで使用可能な周波数帯を報知し、移動局は待ち受け中に逐次在圏セル／セクタ内で使用可能な周波数帯の全受信電力を測定し、発着信接続の際、その最新測定値を基地局に通知し、基地局は自局で測定している上りの各周波数帯の全受信電力測定値と移動局から通知された下りの各周波数帯の全受信電力測定値を用いて、移動局との間に設定する無線回線の周波数帯を決定する。

【００１５】更に、請求項３記載の本発明は、移動局がハンドオーバの起動を判定したときハンドオーバ元基地局から報知された隣接セル／セクタでの使用可能周波数帯の情報に基づき、ハンドオーバ先セル／セクタの各使用可能周波数毎に全受信電力を測定し、該測定結果をハンドオーバ元基地局を介してハンドオーバ先基地局に通知し、ハンドオーバ先基地局は自局で測定している上りの各周波数帯の全受信電力測定値および前記通知された各周波数帯毎の全受信電力測定値に基づいて無線回線を設定する周波数帯を決定することを要旨とする。

【００１６】請求項３記載の本発明にあっては、移動局はハンドオーバの起動を判定したときハンドオーバ元基地局から報知された隣接セル／セクタでの使用可能周波数帯の情報に基づき、ハンドオーバ先セル／セクタの各使用可能周波数毎に全受信電力を測定し、該測定結果をハンドオーバ先基地局に通知し、ハンドオーバ先基地局は自局で測定している上りの各周波数帯の全受信電力測定値および前記通知された各周波数帯毎の全受信電力測定値に基づいて無線回線を設定する周波数帯を決定する。

【００１７】請求項４記載の本発明は、基地局が配下のセル／セクタ内で通信している移動局に対し、すべての隣接セル／セクタについてセル／セクタ毎の使用可能な周波数帯を報知し、移動局が前記報知されたすべての隣接セル／セクタについて隣接セル／セクタ毎に使用可能なすべての周波数帯の全受信電力を逐次測定し、該測定結果を基地局に通知しておき、基地局が移動局のハンドオーバが起動されたときに、ハンドオーバ先基地局で使用可能なすべての周波数帯の全受信電力の最新測定値をハンドオーバ先基地局に対して通知し、ハンドオーバ先基地局が自局で測定している上りの各周波数帯の全受信電力測定値および前記通知された各周波数帯毎の全受信電力測定値に基づいて無線回線を設定する周波数帯を決定することを要旨とする。

【００１８】請求項４記載の本発明にあっては、基地局は移動局に隣接セル／セクタの周波数帯を報知し、移動局は報知された周波数帯の全受信電力を逐次測定し、測定結果を基地局に通知しておき、移動局のハンドオーバ

が起動されたときに、基地局はハンドオーバ先基地局で使用可能な全周波数帯の全受信電力の最新測定値をハンドオーバ先基地局に対して通知し、ハンドオーバ先基地局は自局で測定している上りの各周波数帯の全受信電力測定値および前記通知された各周波数帯毎の全受信電力測定値に基づいて無線回線を設定する周波数帯を決定する。

【００１９】また、請求項５記載の本発明は、請求項２ないし４のいずれかに記載の発明において、前記無線回線を設定する周波数帯の前記決定において、上りおよび下りで全受信電力が最低である周波数帯が同一である場合には、該周波数帯とし、上りおよび下りで全受信電力が最低である周波数帯が異なる場合には、上りおよび下りそれぞれで所定の値よりも小さい全受信電力を有する周波数帯のうち、上りについて全受信電力が最低である周波数帯を選択することを要旨とする。

【００２０】請求項５記載の本発明にあっては、無線回線を設定する周波数帯として、上りおよび下りで全受信電力が最低である周波数帯が同一である場合には、該周波数帯を選択し、上りおよび下りで全受信電力が最低である周波数帯が異なる場合には、上りおよび下りそれぞれで所定の値よりも小さい全受信電力を有する周波数帯のうち、上りについて全受信電力が最低である周波数帯を選択している。

【００２１】更に、請求項６記載の本発明は、基地局装置が、自セル／セクタおよびすべての隣接セル／セクタで使用可能な周波数帯をセル／セクタ毎に記憶する記憶手段と、自基地局の配下のセル／セクタ内に在圏する移動局に対し、逐次、自セル／セクタおよびすべての隣接セル／セクタについてセル／セクタ毎の使用可能な周波数帯を前記記憶手段から読み出して報知する報知手段とを有し、移動局装置が、前記報知手段から報知された周波数帯をセル／セクタ毎に蓄積する蓄積手段と、該蓄積手段に蓄積された周波数帯のうちのセル／セクタ毎に１周波数帯についての希望波受信レベルをすべてのセル／セクタについて測定する測定手段と、この測定結果に基づいて在圏セル／セクタまたはセル／セクタ間の移行状況を判定する判定手段とを有することを要旨とする。

【００２２】請求項６記載の本発明にあっては、基地局は移動局に自セル／セクタおよびすべての隣接セル／セクタで使用可能な周波数帯を報知し、移動局はセル／セクタ毎に使用可能な周波数帯のうちの１周波数帯について希望波受信レベルを測定し、該測定結果に基づいて在圏セル／セクタまたはセル／セクタ間の移行状況を判定する。

【００２３】請求項７記載の本発明は、基地局装置が、自セル／セクタで使用可能な周波数帯を記憶する記憶手段と、自基地局の配下のセル／セクタ内に在圏する移動局に対し、自セル／セクタで使用可能な周波数帯を前記記憶手段から読み出して報知する報知手段とを有し、移動局装置が、待ち受け中に前記報知情報を予め受信する受信手段と、該受信手段で受信した在圏セル／セクタで使用可能な周波数帯の全受信電力を逐次測定する測定手段と、発着信接続の際、在圏セル／セクタ内で使用可能な周波数帯毎の全受信電力の最新測定値を基地局に対して通知する通知手段とを有し、基地局装置が、上りの各周波数帯の全受信電力を測定する測定手段と、該測定手段で測定した上りの各周波数帯の全受信電力測定値および前記通知手段により移動局から通知された下りの各周波数帯の全受信電力測定値を用いて、移動局との間に設定する無線回線の周波数帯を決定する周波数帯決定手段とを有することを要旨とする。

【００２４】請求項７記載の本発明にあっては、基地局は移動局に自セル／セクタで使用可能な周波数帯を報知し、移動局は待ち受け中に逐次在圏セル／セクタ内で使用可能な周波数帯の全受信電力を測定し、発着信接続の際、その最新測定値を基地局に通知し、基地局は自局で測定している上りの各周波数帯の全受信電力測定値と移動局から通知された下りの各周波数帯の全受信電力測定値を用いて、移動局との間に設定する無線回線の周波数帯を決定する。

【００２５】また、請求項８記載の本発明は、移動局装置が、ハンドオーバの起動を判定したときハンドオーバ元基地局から報知された隣接セル／セクタでの使用可能周波数帯の情報に基づき、ハンドオーバ先セル／セクタの各使用可能周波数毎に全受信電力を測定する測定手段と、該測定結果をハンドオーバ元基地局を介してハンドオーバ先基地局に通知する通知手段とを有し、ハンドオーバ先基地局装置が、上りの各周波数帯の全受信電力を測定する測定手段と、前記通知手段から通知された各周波数帯毎の全受信電力測定値に基づいて無線回線を設定する周波数帯を決定する周波数帯決定手段とを有することを要旨とする。

【００２６】請求項８記載の本発明にあっては、移動局はハンドオーバの起動を判定したときハンドオーバ元基地局から報知された隣接セル／セクタでの使用可能周波数帯の情報に基づきハンドオーバ先セル／セクタの周波数毎に全受信電力を測定し、測定結果をハンドオーバ先基地局に通知し、ハンドオーバ先基地局は自局で測定している上りの各周波数帯の全受信電力測定値および前記通知された各周波数帯毎の全受信電力測定値に基づいて無線回線を設定する周波数帯を決定する。

【００２７】更に、請求項９記載の本発明は、基地局装置がすべての隣接セル／セクタについてセル／セクタ毎の使用可能な周波数帯を記憶する記憶手段と、自基地局の配下のセル／セクタ内で通信している移動局に対し、すべての隣接セル／セクタについてセル／セクタ毎の使用可能な周波数帯を前記記憶手段から読み出して報知する報知手段とを有し、移動局装置が前記報知手段から報知されたすべての隣接セル／セクタについて隣接セル／

セクタ毎に使用可能なすべての周波数帯の全受信電力を逐次測定する測定手段と、該測定結果を基地局に通知する通知手段とを有し、基地局装置が移動局のハンドオーバが起動されたときに、ハンドオーバ先基地局で使用可能なすべての周波数帯の全受信電力の最新測定値を前記通知手段で通知された前記測定結果から取り出して、ハンドオーバ先基地局に対して報知する報知手段を有し、ハンドオーバ先基地局装置が上りの各周波数帯の全受信電力を測定する測定手段と、該測定手段で測定した測定値および前記報知手段で報知された各周波数帯毎の全受信電力測定値に基づいて無線回線を設定する周波数帯を決定する周波数帯決定手段とを有することを要旨とする。

【００２８】請求項９記載の本発明にあっては、基地局は移動局に隣接セル／セクタの周波数帯を報知し、移動局は報知された周波数帯の全受信電力を逐次測定し、測定結果を基地局に通知しておき、移動局のハンドオーバが起動されたときに、基地局はハンドオーバ先基地局で使用可能な全周波数帯の全受信電力の最新測定値をハンドオーバ先基地局に対して通知し、ハンドオーバ先基地局は自局で測定している上りの各周波数帯の全受信電力測定値および前記通知された各周波数帯毎の全受信電力測定値に基づいて無線回線を設定する周波数帯を決定する。

【００２９】請求項１０記載の本発明は、請求項７ないし９のいずれかに記載の発明において、前記周波数帯決定手段が上りおよび下りで全受信電力が最低である周波数帯が同一である場合には、該周波数帯を決定し、上りおよび下りで全受信電力が最低である周波数帯が異なる場合には、上りおよび下りそれぞれで所定の値よりも小さい全受信電力を有する周波数帯のうち、上りについて全受信電力が最低である周波数帯を決定する手段を有することを要旨とする。

【００３０】請求項１０記載の本発明にあっては、無線回線を設定する周波数帯として、上りおよび下りで全受信電力が最低である周波数帯が同一である場合には、該周波数帯を選択し、上りおよび下りで全受信電力が最低である周波数帯が異なる場合には、上りおよび下りそれぞれで所定の値よりも小さい全受信電力を有する周波数帯のうち、上りについて全受信電力が最低である周波数帯を選択している。

【００３１】

【発明の実施の形態】以下、図面を用いて本発明の実施の形態について説明する。

【００３２】図１および図２は、それぞれ本発明の一実施形態に係るＣＤＭＡ移動通信システムにおけるセル／セクタ判定および周波数選択方法を実施する基地局および移動局の構成を示すブロック図である。

【００３３】図１に示す基地局装置は、移動局からの無線信号を受信するとともに移動局への無線信号を送信するアンテナ２１を有し、該アンテナ２１で受信した移動局からの信号は送受分配回路２３、受信回路２５を介して復調回路２７に供給され、ここで拡散コードを用いた逆拡散および通常の復調が行われる。復調された信号は復号化回路２９に供給され、伝送信号と制御信号の復号が行われ、制御信号は制御回路３１に供給され、伝送信号は有線回線送信回路３９を介して上位の交換局に送信される。

【００３４】また、交換局から基地局への伝送信号は、有線回線受信回路４１で受信され、伝送信号と制御信号に分解され、制御信号は制御回路３１に供給され、伝送信号は制御回路３１からの制御信号とともに符号化回路３３で符号化され、変調回路３５で一次変調および拡散コードによる拡散変調を施されてから、送信回路３７および送受分配回路２３を介してアンテナ２１から移動局に対して送信される。

【００３５】制御回路３１には記憶回路５５と測定回路５７が接続され、記憶回路５５は自セル／セクタおよびすべての隣接セル／セクタで使用可能な周波数帯をセル／セクタ毎に記憶し、また測定回路５７は上りの各周波数帯の全受信電力を測定するようになっている。

【００３６】図２に示す移動局装置は、基地局からの無線信号を受信するとともに基地局への無線信号を送信するアンテナ１を有し、該アンテナ１で受信した基地局からの信号は送受分配回路３、受信回路５を介して復調回路７に供給され、ここで拡散コードを用いた逆拡散および通常の復調が行われる。復調された信号は復号化回路９に供給されて、伝送信号と制御信号の復号が行われ、制御信号は制御回路１１に供給され、伝送信号はマンマシンインタフェースに供給される。

【００３７】また、マンマシンインタフェースからの音声信号などの伝送信号は、制御回路１１からの制御信号とともに符号化回路１３に供給されて符号化され、変調回路１５で一次変調および拡散コードによる拡散変調され、送信回路１７、送受分配回路３を介してアンテナ１から基地局に対して送信される。

【００３８】制御回路１１には記憶回路５１および測定回路５３が接続され、記憶回路５１は基地局から報知された在圏セル／セクタおよびすべての隣接セル／セクタで使用可能な周波数帯をセル／セクタ毎に記憶し、また測定回路５３は在圏セル／セクタおよび隣接セル／セクタで使用可能な周波数帯の希望波受信レベルや全受信電力を測定するようになっている。

【００３９】以上のように構成される基地局装置および移動局装置を有するＣＤＭＡ移動通信システムにおいては、すべてのセル／セクタで複数の周波数帯を使用し、すべてのセル／セクタですべての周波数帯に移動局のセル／セクタ判定用のパイロットチャネルが配置され、移動局は任意の周波数帯で隣接セルのパイロットチャネルを受信して、セル／セクタ判定を行うようになっている

が、加入者数の少ないエリアにおけるシステムの経済化を図るために、このようなエリアのセル／セクタに配置する周波数帯は少なくされ、セル／セクタによって使用可能な周波数帯が異なっている。そして、このように各セル／セクタによって異なる使用可能な周波数帯を移動局は認識、すなわち記憶していない。

【００４０】このような状態において、移動局がセル／セクタの移行を適確に検出し得るように、本実施形態では、基地局は、記憶回路５５に自セル／セクタおよびすべての隣接セル／セクタで使用可能な周波数帯をセル／セクタ毎に記憶しており、この記憶した周波数帯を読み出して、該基地局の配下のセル／セクタ内に在圏する移動局に対して符号化回路３３、変調回路３５、送信回路３７、送受分配回路２３を介してアンテナ２１から送信して報知するようになっている。

【００４１】移動局は、この報知されたすべてのセル／セクタの使用可能な周波数帯をアンテナ１、送受分配回路３、受信回路５、復調回路７、復号化回路９を介して制御回路１１で受信し、記憶回路５１に記憶する。そして、移動局は、この記憶した周波数帯から、すべてのセル／セクタについてセル／セクタ毎に、使用可能な周波数帯のうちの１つの周波数帯について希望波受信レベルを測定回路５３で測定する。この測定結果に基づいて、移動局は在圏セル／セクタまたはセル／セクタ間の移行状況を適確に判定することができる。具体的な判定方法としては希望波受信レベル測定値が最大であるセル／セクタを在圏セル／セクタと判定すればよい。

【００４２】図３は、本発明の他の実施形態の処理を示すフローチャートである。本実施形態の処理は、移動局の発着信接続時において基地局と移動局との間に設定される無線回線の周波数帯を干渉電力が最も少ないように選択するものである。

【００４３】図３において、基地局は配下のセル／セクタ内に在圏する移動局に対して、自セル／セクタで使用可能な周波数帯を記憶回路５５から読み出して報知する（ステップＳ１１）。移動局は、基地局から報知された使用可能周波数帯を待ち受け中に予め受信し、記憶回路５１に記憶する（ステップＳ１２）。そして、移動局は記憶回路５１から在圏セル／セクタ内で使用可能周波数帯を読み出し、この周波数帯の全受信電力を測定回路５３で逐次測定する（ステップＳ１３）。

【００４４】移動局は、発着信接続の際、ステップＳ１３で測定した在圏セル／セクタ内で使用可能な周波数帯毎の全受信電力の最新測定値を基地局に通知する（ステップＳ１４）。基地局は、自局で測定している上りの各周波数帯の全受信電力測定値とステップＳ１４で移動局から通知された下りの各周波数帯の全受信電力測定値に基づいて移動局との間に設定される無線回線の周波数帯を干渉電力が最も小さくなるように決定する（ステップＳ１５）。

【００４５】図４は、本発明の更に他の実施形態の処理を示すフローチャートである。本実施形態の処理は、移動局のハンドオーバ時においてハンドオーバ先基地局と移動局との間に設定される無線回線の周波数帯を干渉電力が最も少ないように選択するものである。

【００４６】図４において、移動局は、ハンドオーバの起動を判定すると、ハンドオーバ元基地局から報知された隣接セル／セクタでの使用可能周波数帯の情報に基づき、ハンドオーバ先セル／セクタの各使用可能周波数帯毎に全受信電力を測定する（ステップＳ２１）。そして、移動局は、該測定結果をハンドオーバ元基地局を介してハンドオーバ先基地局に通知する（ステップＳ２２）。

【００４７】ハンドオーバ先基地局は、自局で測定している上りの各周波数帯の全受信電力測定値とステップＳ２２で移動局から通知された各周波数帯毎の全受信電力測定値に基づいて移動局との間に設定される無線回線の周波数帯を干渉電力が最も小さくなるように決定する（ステップＳ２３）。

【００４８】図５は、本発明の別の実施形態の処理を示すフローチャートである。本実施形態の処理は、図４の処理と同様に移動局のハンドオーバ時においてハンドオーバ先基地局と移動局との間に設定される無線回線の周波数帯を干渉電力が最も少ないように選択するものであるが、本実施形態では移動局で測定した隣接セル／セクタ毎の使用可能なすべての周波数帯の全受信電力測定値をハンドオーバ起動前に予め基地局に通知しておくことによりハンドオーバをスムーズに行うようにしているものである。

【００４９】図５において、基地局は、配下のセル／セクタ内で通信している移動局に対して、すべての隣接セル／セクタについて、セル／セクタ毎の使用可能な周波数帯を報知する（ステップＳ３１）。移動局は、報知されたすべての隣接セル／セクタについて隣接セル／セクタ毎に使用可能なすべての周波数帯の全受信電力を逐次測定し（ステップＳ３２）、この測定結果を基地局に通知しておく（ステップＳ３３）。

【００５０】基地局は、移動局のハンドオーバが起動された時に、ハンドオーバ先基地局に対して、該ハンドオーバ先基地局で使用可能なすべての周波数帯の全受信電力の最新測定値を通知する（ステップＳ３４）。ハンドオーバ先基地局は、自局で測定している上りの各周波数帯の全受信電力測定値およびステップＳ３４で通知された各周波数帯毎の全受信電力測定値に基づいて移動局との間に設定される無線回線の周波数帯を干渉電力が最も小さくなるように決定する（ステップＳ３５）。

【００５１】次に、図６を参照して、上述した各実施形態において上りの各周波数帯の全受信電力測定値と下りの各周波数帯の全受信電力測定値とに基づいて基地局と移動局との間に設定される無線回線の周波数帯を決定す

る方法について説明する。

【００５２】図６は横軸に上りと下りの各周波数Ｆ１，Ｆ２，Ｆ３を示し、縦軸に全受信電力の測定値を示している。上りと下りのＦ１，Ｆ２，Ｆ３は同じ周波数でなく、単に周波数のペアを示しているものである。

【００５３】図６では、上りおよび下りの周波数帯としてそれぞれＦ１，Ｆ２，Ｆ３の３つの周波数が示され、この３つの周波数帯の中から基地局と移動局との間に設定される無線回線の周波数帯として干渉電力が最低となる周波数帯を選択するのであるが、同図に示すように、全受信電力に所定の値が規定され、この所定の値より大きい全受信電力を有する周波数帯は除外され選択されないようになっている。すなわち、下りの周波数帯において周波数Ｆ２の全受信電力はこの所定の値を超えているので、周波数Ｆ２の周波数帯は選択されない。

【００５４】また、上りおよび下りで全受信電力が両者とも最低である周波数帯があれば、最も望ましく、この周波数帯が選択されることになるが、図６では両者とも最低の周波数帯はない。従って、上りおよび下りで全受信電力が最低である周波数帯が異なる場合には、上りと下りそれぞれで、所定の値より小さい全受信電力を有する周波数帯のうちで、上りの全受信電力が最低である周波数帯を選択する。

【００５５】上りの全受信電力が最低の周波数帯を選択する理由を述べる。所要の受信品質を得るには干渉電力量つまり全受信電力が大きい程大きな送信電力が必要となる。特に上りの送信電力の増加は移動局のバッテリーの消耗を早める事となるため、上りの送信電力はできるだけ小さくする必要がある。よって、移動局のバッテリーセービングを図るには、下りよりも上りの全受信電力が最低の周波数帯を選択する必要がある。

【００５６】従って、図６の例では、周波数Ｆ２は所定の値以上であるので、除外され、残りの周波数帯はＦ１，Ｆ３において上りの周波数Ｆ１，Ｆ３のうち、全受信電力が小さいＦ３が選択されることになる。

【００５７】

【発明の効果】以上説明したように、本発明によれば、基地局は移動局に自セル／セクタおよびすべての隣接セル／セクタで使用可能な周波数帯を報知し、移動局はセル／セクタ毎に使用可能な周波数帯のうちの１周波数帯についてパイロットチャネルの希望波受信レベルを測定し、該測定結果に基づいて在圏セル／セクタまたはセル／セクタ間の移行状況を適確に判定することができる。

【００５８】また、本発明によれば、基地局は移動局に自セル／セクタで使用可能な周波数帯を報知し、移動局は待ち受け中に逐次在圏セル／セクタ内で使用可能な周波数帯の全受信電力を測定し、発着信接続の際、その最新測定値を基地局に通知し、基地局は自局で測定している上りの各周波数帯の全受信電力測定値と移動局から通知された下りの各周波数帯の全受信電力測定値を用いて、移動局との間に設定する無線回線の周波数帯を決定するので、移動局の負荷を増大することなく、周波数帯毎の全受信電力を測定し、干渉電力の最も小さい周波数帯を選択することができる。

【００５９】更に、本発明によれば、移動局はハンドオーバの起動を判定したときハンドオーバ元基地局から報知された隣接セル／セクタでの使用可能周波数帯の情報に基づき、ハンドオーバ先セル／セクタの各使用可能周波数毎に全受信電力を測定し、該測定結果をハンドオーバ先基地局に通知し、ハンドオーバ先基地局は自局で測定している上りの各周波数帯の全受信電力測定値および前記通知された各周波数帯毎の全受信電力測定値に基づいて無線回線を設定する周波数帯を決定するので、移動局の負荷を増大することなく、周波数帯毎の全受信電力を測定し、干渉電力の最も小さい周波数帯を選択することができる。

【００６０】本発明によれば、基地局は移動局に隣接セル／セクタの周波数帯を報知し、移動局は報知された周波数帯の全受信電力を逐次測定し、測定結果を基地局に通知しておき、移動局のハンドオーバが起動されたときに、移動局はハンドオーバ先基地局で使用可能な全周波数帯の全受信電力の最新測定値をハンドオーバ先基地局に対して通知し、ハンドオーバ先基地局は自局で測定している上りの各周波数帯の全受信電力測定値および前記通知された各周波数帯毎の全受信電力測定値に基づいて無線回線を設定する周波数帯を決定するので、移動局の負荷を増大することなく、周波数帯毎の全受信電力を測定し、干渉電力の最も小さい周波数帯を選択することができる。

【００６１】また、本発明によれば、無線回線を設定する周波数帯として、上りおよび下りで全受信電力が最低である周波数帯が同一である場合には、該周波数帯を選択し、上りおよび下りで全受信電力が最低である周波数帯が異なる場合には、上りおよび下りそれぞれで所定の値よりも小さい全受信電力を有する周波数帯のうち、上りについて全受信電力が最低である周波数帯を選択しているので、干渉電力が最低となる周波数帯を選択し、移動局のバッテリーセービングを図ることができる。

【図面の簡単な説明】

【図１】本発明の一実施形態に係るＣＤＭＡ移動通信システムにおけるセル／セクタ判定および周波数選択方法を実施する基地局の構成を示すブロック図である。

【図２】本発明の一実施形態に係るＣＤＭＡ移動通信システムにおけるセル／セクタ判定および周波数選択方法を図１の基地局とともに実施する移動局の構成を示すブロック図である。

【図３】本発明の他の実施形態の処理を示すフローチャートである。

【図４】本発明の更に他の実施形態の処理を示すフローチャートである。

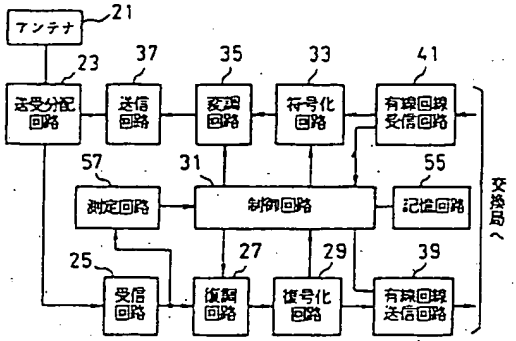
【図５】本発明の別の実施形態の処理を示すフローチャートである。

【図６】上記各実施形態において上りの各周波数帯の全受信電力測定値と下りの各周波数帯の全受信電力測定値とに基づいて基地局と移動局との間に設定される無線回線の周波数帯を決定する方法を説明するために使用される図であり、横軸に上りと下りの各周波数を示し、縦軸に全受信電力測定値を示している。

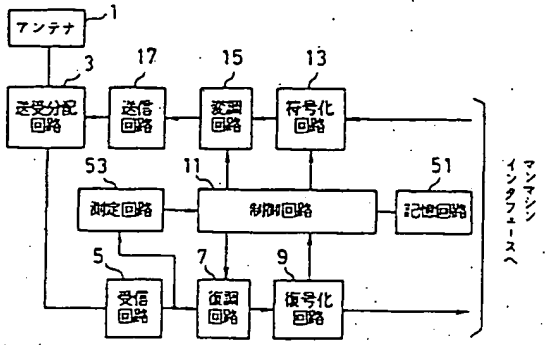
【符号の説明】

１１　移動局の制御回路
３１　基地局の制御回路
５１　移動局の記憶回路
５３　移動局の測定回路
５５　基地局の記憶回路
５７　基地局の測定回路

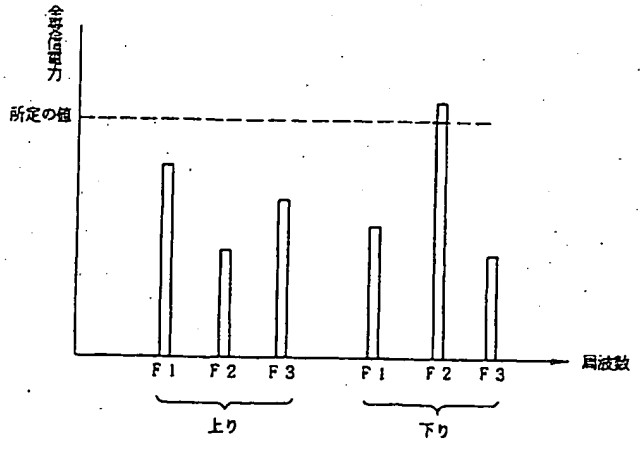
【図１】



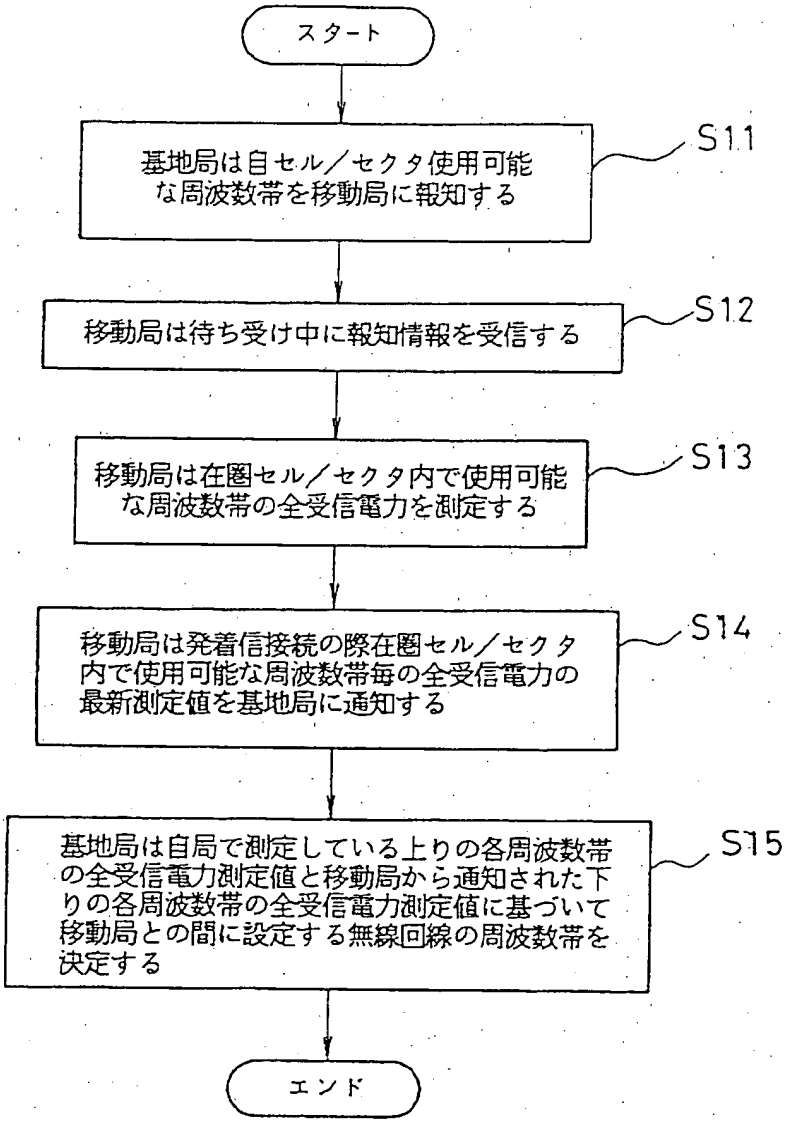
【図２】



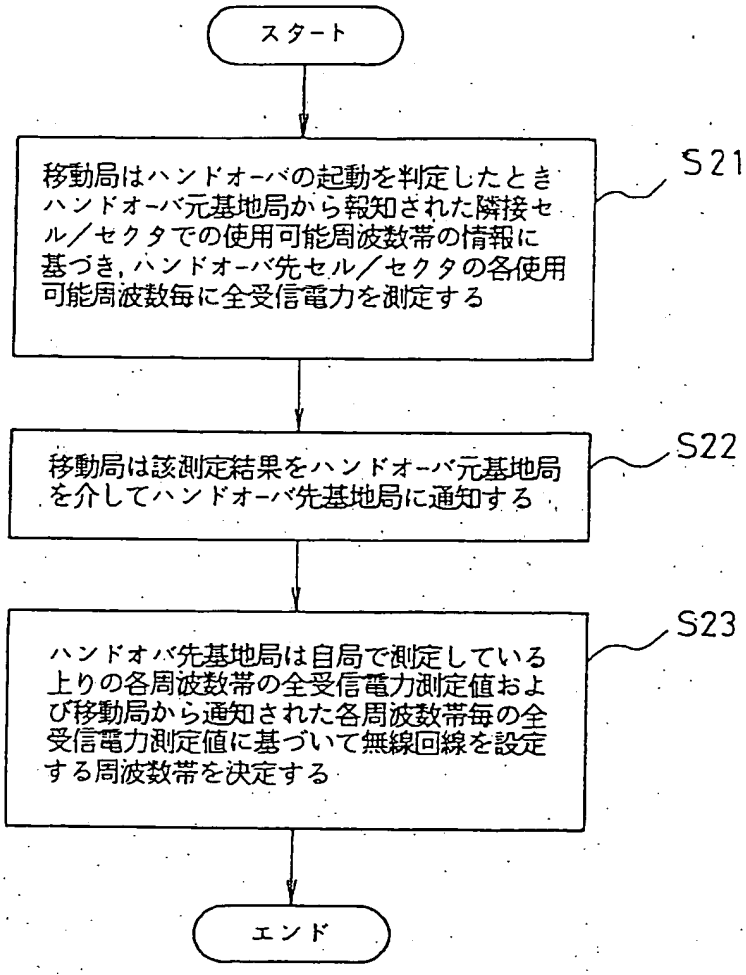
【図６】



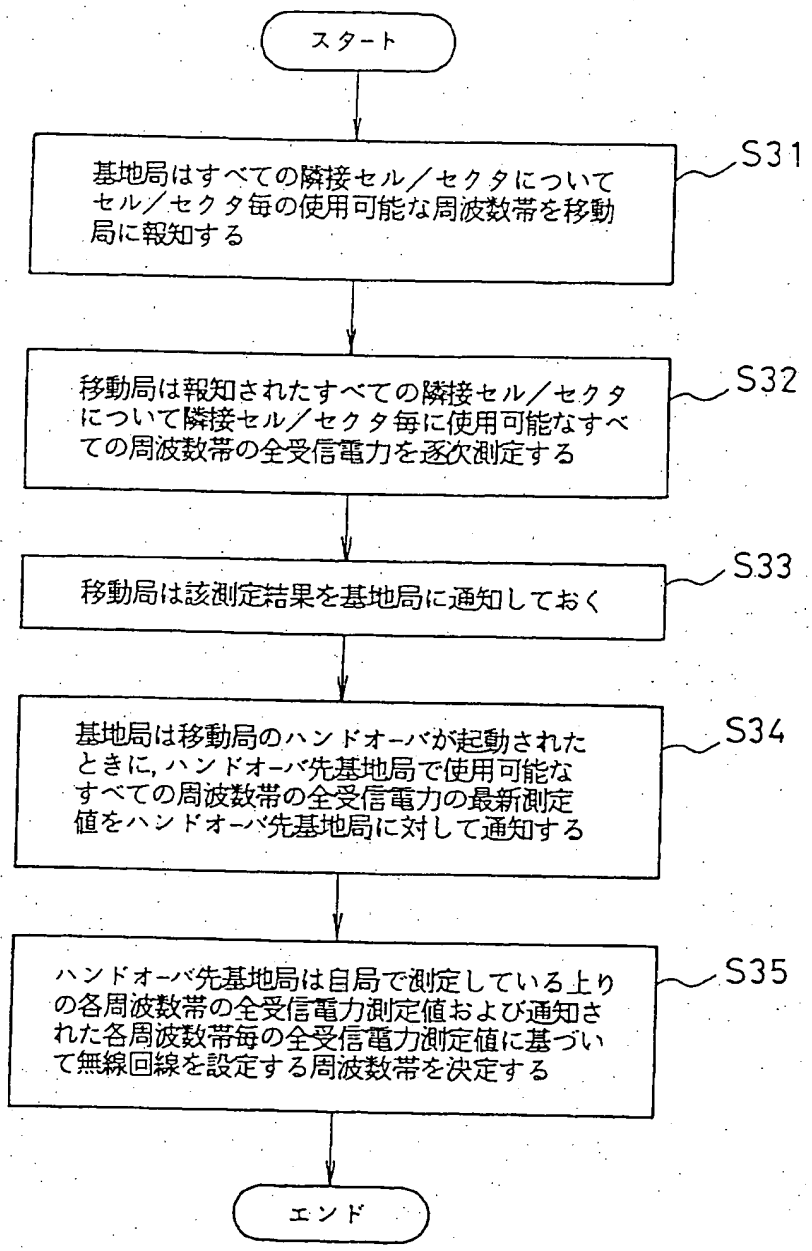
【図３】


スタート
基地局は自セル／セクタ使用可能な周波数帯を移動局に報知する
S11
移動局は待ち受け中に報知情報を受信する
S12
移動局は在圏セル／セクタ内で使用可能な周波数帯の全受信電力を測定する
S13
移動局は発着信接続の際在圏セル／セクタ内で使用可能な周波数帯毎の全受信電力の最新測定値を基地局に通知する
S14
基地局は自局で測定している上りの各周波数帯の全受信電力測定値と移動局から通知された下りの各周波数帯の全受信電力測定値に基づいて移動局との間に設定する無線回線の周波数帯を決定する
S15
エンド

【図４】


スタート
移動局はハンドオーバの起動を判定したときハンドオーバ元基地局から報知された隣接セル／セクタでの使用可能周波数帯の情報に基づき，ハンドオーバ先セル／セクタの各使用可能周波数毎に全受信電力を測定する
S21
移動局は該測定結果をハンドオーバ元基地局を介してハンドオーバ先基地局に通知する
S22
ハンドオバ先基地局は自局で測定している上りの各周波数帯の全受信電力測定値および移動局から通知された各周波数帯毎の全受信電力測定値に基づいて無線回線を設定する周波数帯を決定する
S23
エンド

【図５】


スタート
基地局はすべての隣接セル／セクタについてセル／セクタ毎の使用可能な周波数帯を移動局に報知する
S31
移動局は報知されたすべての隣接セル／セクタについて隣接セル／セクタ毎に使用可能なすべての周波数帯の全受信電力を逐次測定する
S32
移動局は該測定結果を基地局に通知しておく
S33
基地局は移動局のハンドオーバが起動されたときに，ハンドオーバ先基地局で使用可能なすべての周波数帯の全受信電力の最新測定値をハンドオーバ先基地局に対して通知する
S34
ハンドオーバ先基地局は自局で測定している上りの各周波数帯の全受信電力測定値および通知された各周波数帯毎の全受信電力測定値に基づいて無線回線を設定する周波数帯を決定する
S35
エンド

ENGLISH TRANSLATION OF JAPANESE LAID-OPEN PATENT PUBLICATION NO. 10-28282 (filed on July 12, 1996)

[Title of the Invention]

CELL/SECTOR DETERMINATION AND FREQUENCY SELECTION METHOD, BASE STATION DEVICE, AND MOBILE STATION DEVICE IN A CDMA MOBILE COMMUNICATION SYSTEM

[Abstract]

[Objective] To provide a cell/sector determination and frequency selection method, a base station device, and a mobile station device in a CDMA mobile communication system that enable the proper detection of the transition of the cell/sector even when the available frequency bands vary depending on the cell/sector, and the selection of a frequency band that can keep the interference electric power to a minimum.

[Solution Means] The base station informs the mobile station of the frequency bands available in its own cell/sector (step S11); the mobile station receives the above information while still waiting for the connection, iteratively measuring the total reception electric power of the frequency bands available in its residing cell/sector, and, upon connection of the call, notifies the base station of the latest total reception electric power measurements of each of the frequency bands available in its residing cell/sector (step S12-S14). The base station determines the frequency band establishing the wireless circuit between said base station and the mobile station based on the total reception electric power measurements of each of the uplink frequency bands and the notified total reception electric power measurements of each of the downlink frequency bands (step S15).

[Claims]

1. A cell/sector determination and frequency selection method in a CDMA mobile communication system,

characterized in that:

a base station iteratively informs a mobile station residing in its cell/sector of the frequency bands available in each cell/sector for its own cell/sector and all the adjacent cells/sectors;

said mobile station measures the desired wave reception level of a pilot channel, which is a carrier for determining the residing cell/sector of said mobile station, of one of the frequency bands among said frequency bands available in each cell/sector for all the cells/sectors informed by the base station; and,

determines the residing cell/sector or the transition of the cell/sector of said mobile station.

2. A cell/sector determination and frequency selection method in a CDMA mobile communication system, characterized in that:

the base station informs the mobile station residing in its cell/sector of the available frequency bands in its own cell/sector;

the mobile station receives said information while still waiting to be connected and iteratively measures the total reception electric power of the frequency bands available in its residing cell/sector;

upon connection of the call, the mobile station notifies the base station of the latest measurements of said total reception electric power of each of the frequency bands available in its residing cell/sector; and,

the base station determines the frequency band that establishes a wireless circuit between said base station and the mobile station, using the total reception electric power measurements of each of the uplink frequency bands measured at its own station and the total reception electric power measurements of each of the downlink frequency bands notified by the mobile station.

3. A cell/sector determination and frequency

selection method in a CDMA mobile communication system, characterized in that:

upon the determination of a handoff initiation, the mobile station measures the total reception electric power of each of the frequency bands available in a handoff cell/sector based on the information on the frequency bands available in the adjacent cells/sectors notified by the originating base station; and,

notifies a handoff base station of said measuring results via the originating base station; and,

the handoff base station determines the frequency band establishing the wireless circuit based on the total reception electric power measurements of each of the uplink frequency bands measured at its own station and said notified total reception electric power measurements of each of the frequency bands.

4. A cell/sector determination and frequency selection method in a CDMA mobile communication system, characterized in that:

the base station informs the mobile station communicating in its cell/sector of the frequency bands available in each cell/sector for all the adjacent cells/sectors;

the mobile station iteratively measures the total reception electric power of all the frequency bands available in each adjacent cell/sector for all the informed adjacent cells/sectors and notifies the base station of said measuring results;

upon the handoff initiation of the mobile station, the base station notifies the handoff base station of the latest total reception electric power measurements for all the frequency bands available in the hand off base station; and,

the handoff base station determines the frequency band establishing the wireless circuit based on the total reception electric power measurements of each of the uplink

frequency bands measured at its own station and said notified total reception electric power measurements of each of the frequency bands.

5. The cell/sector determination and frequency selection method in a CDMA mobile communication system as claimed in any one of claims 2 through 4, characterized in that:

a frequency band with the lowest total reception electric power in both the uplink and downlink frequency bands is selected in said determination of the frequency band establishing the wireless circuit, if such frequency band exists; and,

a frequency band with the lowest total reception electric power in the uplink frequency band is selected among the frequency bands whose total reception electric power measurements are below a predetermined value in both the uplink and downlink frequency bands, if the frequency band having the lowest total reception electric power is different for the uplink and downlink frequency bands.

6. A base station device and a mobile station device in a CDMA mobile communication system, characterized in that:

the base station device is provided with storage means for storing information on the frequency bands available in each cell/sector for its own cell/sector and all the adjacent cells/sectors, and informing means for iteratively reading from said storage means the information on the frequency bands available in each cell/sector for its own cell/sector and all the adjacent cells/sectors and informing this to the mobile station residing in a cell/sector covered by said base station; and,

the mobile station device is provided with accumulation means for accumulating the frequency bands from said informing means for each cell/sector, measuring means for measuring the desired wave reception level of one

frequency band in each cell/sector among the frequency bands accumulated in said accumulation means, said measurement being made for all the cells/sectors, and determination means for determining the residing cell/sector or the transition of the cell/sector of said mobile station.

7. A base station device and a mobile station device in a CDMA mobile communication system, characterized in that:

the base station device is provided with storage means for storing information on the frequency bands available in its own cell/sector, and informing means for reading the information on the frequency bands available in its own cell/sector from said storage means and informing this to the mobile station residing in a cell/sector covered by said base station;

the mobile station device is provided with reception means for receiving said information while still waiting for the connection, measuring means for iteratively measuring the total reception electric power of the frequency bands available in the residing cell/sector of said mobile station received at said reception means, and notifying means for notifying the base station, upon connection of the call, of the latest total reception electric power measurements of each of the frequency bands available in its residing cell/sector; and,

the base station is provided with measuring means for measuring the total reception electric power of each of the uplink frequency bands, and frequency band determination means for determining the frequency band establishing the wireless circuit between said base station and the mobile station, using the total reception electric power measurements of each of the uplink frequency bands measured at said measuring means and the total reception electric power measurements of each of the downlink frequency bands notified by said notifying means of the mobile station.

8. A base station device and a mobile station device in a CDMA mobile communication system, characterized in that:

the mobile station device is provided with measuring means for measuring the total reception electric power of each of the frequency bands available in the handoff cell/sector based on the information on the frequency bands available in the adjacent cells/sectors informed by the originating base station upon the determination of a handoff initiation, and notifying means for notifying the handoff base station of said measurement results via the originating base station; and,

the handoff base station is provided with measuring means for measuring the total reception electric power of each of the uplink frequency bands, and frequency band determination means for determining the frequency band establishing the wireless circuit based on the total reception electric power measurements of each of the frequency bands notified by said notifying means.

9. A base station device and a mobile station device in a CDMA mobile communication system, characterized in that:

the base station device is provided with storage means for storing information on the frequency bands available in each cell/sector for all the adjacent cells/sectors, and informing means for reading the information on the available frequency bands of each cell/sector for all the adjacent cells/sectors from said storage means and informing the mobile station communicating within a cell/sector covered by said base station of said information; and,

the mobile station is provided with measuring means for iteratively measuring the total reception electric power of all the frequency bands available in each adjacent cell/sector for all the adjacent cells/sectors informed by said informing means, and notifying means for notifying the

base station of said measurement results; wherein,

the base station is provided with informing means for taking out the latest total reception electric power measurements of all the frequency bands available in the handoff base station and informing the handoff base station upon the initiation of the handoff of the mobile station; and,

the handoff base station is provided with measuring means for measuring the total reception electric power of each of the uplink frequency bands, and frequency band determination means for determining the frequency band establishing the wireless circuit based on the measurements from said measuring means and the total reception electric measurements of each of the frequency bands informed by said informing means.

10. The base station device and a mobile station device in a CDMA mobile communication system as claimed in any one of claims 7 through 9, characterized by:

having determining means for determining a frequency band with the lowest total reception electric power in both the uplink and downlink frequency bands, if such frequency band exists, or determining a frequency band with the lowest total reception electric power in the uplink frequency band among the frequency bands whose total reception electric power measurements are below a predetermined value in both the uplink and downlink frequency bands, if the frequency band having the lowest total reception electric power is different for the uplink and downlink frequency bands.

[Detailed Description of the Invention]

[Technical Field of the Invention]

The present invention relates to a cell/sector determination and frequency selection method, a base station device, and a mobile station device, in a code division multiple access (referred to as CDMA hereinafter) mobile communication system, capable of determining the

transition of a cell/sector and of selecting an appropriate frequency band for the wireless circuit when the available frequency bands vary depending on the cell/sector.

[The Conventional Art]

In the CDMA digital mobile communication system according to the conventional art, all cells/sectors use the same set of frequency bands, and in each of these cells/sectors, a pilot channel (i.e. a perch channel), which is a carrier for determining the cell/sector of the mobile station, is provided for each of the frequency bands. In this way, the mobile station can receive the pilot channel of an adjacent cell/sector using any one of the above frequency bands, and can determine the cell/sector.

However, in an area where the number of subscribers is limited, the number of frequency bands will have to be reduced from an economic standpoint. When the frequency bands established in a cell/sector are reduced for economic reasons, as described above, the available frequency bands will vary depending on the cell/sector.

In the conventional CDMA mobile communication system, the mobile station is not cognizant of the unavailable frequency bands in each cell/sector; therefore, the newly transitioned cell/sector may not be provided with the frequency band that the mobile station is to receive for determining the cell/sector. Since the new cell/sector is not provided with the pilot channel for the above frequency in the above case, the mobile station is unable to detect the transition of the cell/sector.

As for the frequency band of the wireless circuit that is to be used, a frequency band having the minimum interference electric power in the uplink and downlink frequency bands should be chosen so as to optimize the quality of the wireless circuit. The uplink interference electric power can be measured at the base station, but the downlink interference electric power, which varies depending on the position of the mobile station and changes with time, can only be measured at the mobile station. Also,

taking into account the anticipated realization of information services, such as of stock information, weather forecast information, traffic information and the like, the uplink and downlink interference electric power level may be asymmetrical, thus necessitating the measurement of the downlink interference electric power.

However, the mobile station is not cognizant of the frequency bands used in its residing cell/sector, and is therefore incapable of measuring the total reception electric power of each of the frequency bands. The mobile station can measure the total reception electric power for all the potential frequency bands, but this means that measurements will be made even for the frequency bands that are not actually used, resulting in the meaningless increase in the load of the mobile station.

[Problem to be Solved by the Invention]

In the mobile communication system according to the conventional art as described above, the mobile station is unable to detect the transition of the cell/sector in a case where the new cell/sector is not provided with the frequency band that is to be received by the mobile station for determining the cell/sector, due to the fact that the available frequency bands vary depending on the cell/sector.

Also, since the frequency band having the lowest interference electric power is selected, the downlink interference electric power, namely, the total reception electric power, needs to be measured for each frequency band available in its residing cell/sector. However, the mobile station is not cognizant of the frequency bands available in its residing cell/sector and is thus unable to measure the total reception electric power of each of the frequency bands.

Consequently, the mobile station can measure the total reception electric power for all the potential frequency bands, but then frequency bands that are not used

will also be included in the measurement, resulting in a meaningless increase in the load of the mobile station.

The present invention has been developed in response to the above-described problems of the conventional art and its object is to provide a cell/sector determination and frequency selection method, a base station device and a mobile station device in a CDMA mobile communication system that is capable of properly detecting the transition of the cell/sector and selecting a frequency band which keeps the interference electric power to a minimum, even when the available frequency bands vary depending on the cell/sector.

[Means used to Solve the Problem]

To achieve the above-described objective, the present invention according to claim 1 provides: a base station that iteratively informs the mobile station residing in the cell/sector covered by said base station of the frequency bands available in each cell/sector for its own cell/sector and its adjacent cell/sector; and a mobile station that measures the desired wave reception level of one frequency band among the frequency bands available in each cell/sector for all the informed cells/sectors, and determines its residing cell/sector or the transition of the cell/sector from one to another, based on the results from said measurements.

According to the present invention as claimed in claim 1, the base station iteratively informs the mobile station of the frequency bands available in its own cell/sector as well as the adjacent cells/sectors; the mobile station measures the desired wave reception level of the pilot channel of one frequency band among the frequency bands available in each cell/sector for all the informed cells/sectors, and determines its residing cell/sector or the transition of the cell/sector from one to another, based on the results from said measurements.

Also, the present invention as claimed in claim 2

provides: a base station that notifies the mobile station residing in a cell/sector covered by said base station of the frequency bands available in its own cell/sector; and a mobile station that receives said notification information while still waiting to be connected and iteratively measures the total reception electric power of each frequency band available in its residing cell/sector; wherein the mobile station, upon connection of the call, notifies the base station of the latest measurements of the total reception electric power of each frequency band available in its residing cell/sector; and the base station determines the frequency band of the wireless circuit, which is to be established in between said base station and the mobile station, using the total reception electric power measurements of each of the uplink frequency bands measured at its own station and the total reception electric power measurements of each of the downlink frequency bands notified by the mobile station.

According to the present invention as claimed in claim 2, the base station notifies the mobile station of the frequency bands available in its own cell/sector; the mobile station measures the total reception electric power of each of the frequency bands available in its residing cell/sector while still waiting for the connection and notifies the base station of the latest measurements upon connection of the call; and the base station determines the frequency band of the wireless circuit, which is to be established in between said base station and the mobile station, using the total reception electric power measurements of each of the uplink frequency bands measured at its own station and the total reception electric power measurements of each of the downlink frequency bands notified by the mobile station.

Further, the present invention as claimed in claim 3 provides: a mobile station that measures the total reception electric power of each of the frequency bands available in the handoff cell/sector, upon detection of a

handoff process, based on the information on the frequency bands available in the adjacent cells/sectors informed by the originating base station, and notifies the handoff base station of the results from the above measurements via the originating base station; wherein the handoff base station determines the frequency band establishing the wireless circuit based on the total reception electric power measurements of each of the uplink frequency bands measured at its own station and the total reception electric power measurements of each of the frequency bands notified by the mobile station.

According to the present invention as claimed in claim 3, the mobile station, upon determining a handoff initiation, measures the total reception electric power of each of the frequency bands available in the handoff cell/sector based on the information on the frequency bands available in the adjacent cells/sectors notified by the originating base station and notifies the handoff base station of the results from the above measurements; and the handoff base station determines the frequency band establishing the wireless circuit based on the total reception electric power measurements of each of the uplink frequency bands measured at its own station and the total reception electric power measurements of each of the frequency bands notified by the mobile station.

The present invention as claimed in claim 4 provides: a base station that informs the mobile station communicating within a cell/sector covered by said base station of the frequency bands available in each cell/sector for all the adjacent cells/sectors; a mobile station that iteratively measures the total reception electric power of each of the frequency bands available in each of the above notified adjacent cells/sectors and notifies the base station of the results of the measurement; wherein the base station, upon the mobile station's initiation of the handoff process, notifies the handoff base station of the latest measurements of the total

reception electric power of all the frequency bands available in the handoff base station; and the handoff base station determines the frequency band that establishes the wireless circuit based on the total reception electric power measurements of each of the uplink frequency bands measured at its own station, and the above notified total reception electric power measurements of each of the downlink frequency bands.

According to the present invention as claimed in claim 4, the base station notifies the mobile station of the frequency bands available in the adjacent cells/sectors; the mobile station iteratively measures the total reception electric power of the above notified frequency bands and notifies the base station of the resulting measurements; the base station, upon the mobile station's initiation of the handoff process, notifies the handoff base station of the latest measurements of the total reception electric power of all the available frequency bands; the handoff base station determines the frequency band that establishes the wireless circuit based on the total reception electric power measurements of each of the uplink frequency bands measured at its own station, and the above notified total reception measurements of each of the frequency bands.

Further, the present invention as claimed in claim 5 provides a cell/sector determination and frequency selection method according to any one of claims 2 through 4, wherein said determination of the frequency band establishing said wireless circuit involves: selecting the frequency band that has the lowest total reception electric power in both the uplink and the downlink if such frequency band exists; and selecting the frequency band that has the lowest total reception electric power in the uplink frequency band, among the frequency bands that have a total reception electric power below a predetermined value in both the uplink and the downlink, if the frequency band with the lowest total reception electric power is different for

the uplink and the downlink frequency bands.

According to the present invention as claimed in claim 5, the frequency band that has the lowest total reception electric power in both the uplink and the downlink is selected as the frequency band for establishing the wireless circuit, if such frequency band exists; and the frequency band that has the lowest total reception electric power in the uplink frequency band, among the frequency bands that have a total reception electric power lower than a predetermined value in both the uplink and the downlink, is selected if the frequency band with the lowest total reception electric power is different for the uplink and the downlink frequency bands.

Further, the present invention as claimed in claim 6 provides: a base station device having storage means for storing information on the frequency bands available in each cell/sector for its own cell/sector and the adjacent cells/sectors, and informing means for reading the information on the frequency bands available in each cell/sector for its own cell/sector and the adjacent cells/sectors from said storage means and giving notification of this information to the mobile station residing in a cell/sector covered by said base station; and a mobile station device having accumulation means for accumulating information on the available frequency bands in each cell/sector, notified by said notifying means, measuring means for measuring the desired wave reception level of one frequency band among the frequency bands accumulated in said accumulation means for each of the cells/sectors, and determination means for determining its residing cell/sector or the transition of the cell/sector, based on the results of the measurements.

According to the present invention as claimed in claim 6, the base station notifies the mobile station of the available frequency bands in its own cell/sector and all the adjacent cells/sectors. The mobile station measures the desired wave reception level of one frequency

band among the available frequency bands for each of the cells/sectors and determines the residing cell/sector or the transition of the cell/sector, based on said results from the measurements.

The present invention as claimed in claim 7 provides: a base station device having storage means for storing the available frequency bands in its own cell/sector, and informing means for reading the information on the available frequency bands in its own cell/sector and informing the mobile station residing in a cell/sector covered by said base station of this information; and a mobile station having reception means for receiving said notification information while still waiting to be connected, measuring means for iteratively measuring the total reception electric power of the available frequency bands in its residing cell/sector based on the information that has been received at said reception means, and notification means for notifying the base station of the latest measurements of the total reception electric power of each of the available frequency bands in the residing cell/sector, upon connection of the call; wherein the base station has measuring means for measuring the total reception electric power of each of the uplink frequency bands, and frequency band determination means for determining the frequency band of the wireless circuit, which is established in between said base station and the mobile station, using the total reception electric power measurements of each of the uplink frequency bands measured by said measuring means and the total reception electric power measurements of each of the downlink frequency bands notified by said notifying means of the mobile station.

According to the present invention as claimed in claim 7, the base station notifies the mobile station of the available frequency bands in its own cell/sector; and the mobile station device iteratively measures the total reception electric power of the available frequency bands in the residing cell/sector while still waiting to be

connected and informs the base station of the latest measurements upon connection of the call. The base station determines the frequency band of the wireless circuit, which is established between said base station and the mobile station, using the measurements of the total reception electric power of each of the uplink frequency bands measured at its own station and the measurements of the total reception electric power of each of the downlink frequency bands notified by the mobile station.

Also, the present invention as claimed in claim 8 provides: a mobile station device having measuring means for measuring the total reception electric power of each and every available frequency band in the handoff cell/sector based on the information on the available frequency bands in the adjacent cells/sectors notified by the originating base station upon determination of the handoff initiation, and notification means for giving notification of said measurement results to the handoff base station via the originating base station; and a handoff base station device having measuring means for measuring the total reception electric power of each of the uplink frequency bands, and frequency band determination means for determining the frequency band that establishes the wireless circuit based on the total reception electric power measurements for each of the frequency bands notified by said notifying means.

According to the present invention as claimed in claim 8, the mobile station measures the total reception electric power of each of the frequency bands available in the handoff cell/sector based on the information on the available frequency bands in the adjacent cell/sector notified by the originating base station upon determination of the handoff initiation, and notifies the handoff base station of the measured results; and the handoff base station determines the frequency band establishing the wireless circuit based on the total reception electric power measurements of each of the uplink frequency bands

measured at its own station and said notified total reception electric power measurements of each of the downlink frequency bands.

Further, the present invention as claimed in claim 9 provides: a base station device having storage means for storing information on the available frequency bands of each cell/sector for the adjacent cells/sectors, and informing means for reading the information on the available frequency bands of each cell/sector for all the adjacent cells/sectors from said storage means and informing the mobile station communicating in a cell/sector covered by said base station; and a mobile station device having measuring means for iteratively measuring the total reception electric power of the available frequency bands of each cell/sector for all the adjacent cells/sectors informed by said informing means, and notifying means for making notification of said measuring results to the base station; wherein the base station device is provided with informing means for taking out the latest measurements of the total reception electric power of all the available frequency bands in the handoff base station and informing the handoff base station of the above information upon the mobile station's initiation of the handoff process; and the handoff base station device is provided with measuring means for measuring the total reception electric power of each of the uplink frequency bands, and frequency band determination means for determining the frequency band that establishes the wireless circuit based on the measurements from said measuring means and the total reception electricity power measurements of each frequency band notified by said notifying means.

According to the present invention as claimed in claim 9, the base station informs the mobile station of the frequency bands of the adjacent cells/sectors; the mobile station iteratively measures the notified total reception electric power of the frequency bands and notifies the base station of the measuring results; the base station notifies

the handoff base station of the latest measurements of the total reception electric power of all the frequency bands available at the handoff base station upon the handoff initiation of the mobile station; the handoff base station determines the frequency band that establishes the wireless circuit based on the total reception electric power measurements of each of the uplink frequency bands measured at its own station and the total reception electric power measurements of each of said notified frequency bands.

The present invention as claimed in claim 10 is the invention according to any one of claims 7 through 9 wherein said frequency band determination means further comprises determining the frequency band that has the lowest total reception electric power in both the uplink and the downlink if such frequency band exists; and determining the frequency band that has the lowest total reception electric power in the uplink frequency band, among the frequency bands that have a total reception electric power below a predetermined value in both the uplink and the downlink frequency bands, if the frequency band with the lowest total reception electric power is different for the uplink and the downlink frequency bands.

According to the present invention as claimed in claim 10, the frequency band that measures the lowest total reception electric power in both the uplink and the downlink frequency bands is selected when such frequency band exists, and the frequency band that has the lowest total reception electric power in the uplink frequency band, among the frequency bands that have a total reception electric power lower than a predetermined value in both the uplink and the downlink frequency bands is selected, if the frequency band with the lowest total reception electric power is different for the uplink and the downlink frequency bands.

[Embodiments of the Present Invention]

In the following, embodiments of the present invention is given with reference to the accompanying

drawings.

FIGS.1 and 2 are block diagrams showing the structure of the base station and the mobile station, each according to an embodiment of the present invention, that execute the cell/sector determination and frequency selection method in the CDMA mobile communication system.

The base station device shown in FIG.1 comprises an antenna 21 for receiving wireless signals from the mobile station as well as transmitting wireless signals to the mobile station. Signals from the mobile station received at said antenna 21 are supplied to a demodulating circuit 27 via a transmission/reception distribution circuit 23 and a reception circuit 25. Here, a despreading process using spreading codes and a normal demodulation process are performed. The demodulated signals are supplied to a decoding circuit 29 wherein transmission signals and control signals are decoded. The above control signals are supplied to a control circuit 31 and the transmission signals are transmitted to a switching station via a cable transmission circuit 39.

Also, transmission signals from the switching station to the base station are received via a cable reception circuit 41 and are broken up into transmission signals and control signals wherein said control signals are supplied to the control circuit 31 and said transmission signals are encoded at an encoding circuit 33, along with the control signals from the control circuit 31. Then, a primary modulation process and a spreading process using spreading codes are performed after which the signals are transmitted to the mobile station from the antenna 21 via the transmission circuit 37 and the transmission/reception distribution circuit 23.

The control circuit 31 is connected to a storage circuit 55 and a measuring circuit 57, wherein the storage circuit 55 stores the available frequency bands of each cell/sector for its own cell/sector as well as all the adjacent cells/sectors and the measuring circuit measures

the total reception electric power of each of the uplink frequency bands.

The mobile station device shown in FIG.2 comprises an antenna 1 for receiving wireless signals from the base station as well as transmitting wireless signals to the base station. The signals from the base station received at the antenna 1 are supplied to a demodulation circuit 7 via a transmission/reception distribution circuit 3 and a reception circuit 5 after which a despreading process using spreading codes and a normal demodulation process are performed. The demodulated signals are supplied to the decoding circuit 9 where transmission signals and control signals are decoded, the control signals being supplied to a control circuit 11 and the transmission signals being supplied to a man-machine interface.

Also, transmission signals such as voice signals from the man-machine interface are supplied to an encoding circuit 13 along with the control signals from the control circuit 11 and encoded therein. Then a primary modulation process and a spreading process using spreading codes are performed on the signals at a modulation circuit 15, after which the signals are transmitted to the base station from the antenna 1 via the transmission circuit 17 and the transmission/reception distribution circuit 3.

The control circuit 11 is connected to a storage circuit 51 and a measuring circuit 53, wherein the storage circuit 51 stores the information on the available frequency bands of each cell/sector for its residing cell/sector and all the adjacent cells/sectors informed by the base station, and the measuring circuit 53 measures the desired wave reception level or the total reception electric power of the available frequency bands in its residing cell/sector and the adjacent cells/sectors.

A CDMA mobile communication system comprising a base station device and a mobile station device with the above-described structure is arranged such that, a plurality of frequency bands is used in all the

cells/sectors, and a pilot channel for determining the cell/sector of the mobile device is assigned to each of the frequency bands in all the cells/sectors, wherein the mobile station receives a pilot channel of an adjacent cell/sector with any one of the frequency bands and determines its cell/sector. However, in an area where the number of subscribers is limited, the frequency bands assigned to the cells/sectors are reduced for economization of the system. As a result, the available frequency bands in a cell/sector will vary depending on the cell/sector and the mobile station will not be able to recognize the differences in the available frequency bands in each of the cells/sectors.

According to the present embodiment, the base station stores information on the available frequency bands in each cell/sector for its own cell/sector and adjacent cells/sectors in the storage circuit 55, reads the stored information, and informs the mobile station residing in the cell/sector covered by said base station by transmitting this information from the antenna 21 via the encoding circuit 33, the modulation circuit 35, the transmission circuit 37 and the transmission/reception distribution circuit 23. In this way, the mobile station can properly detect the transition of the cell/sector.

The mobile station receives said information on the available frequency bands of all the cells/sectors at the control circuit 11 via the antenna 1, the transmission/reception distribution circuit 3, the reception circuit 5, the demodulation circuit 7, the decoding circuit 9, and stores this in the storage circuit 51. Then, from the stored frequency band information, the mobile station measures the desired wave reception level at the measuring circuit 53 for one frequency band among the available frequency bands in each cell/sector for all the cells/sectors. Based on the above measurement results, the mobile station can properly determine its residing cell/sector or the transition of the cells/sectors. A

specific determination method would be to determine the cell/sector having the maximum desired wave reception level measurement value as its residing cell/sector.

FIG.3 is a flow chart illustrating a process according to another embodiment of the present invention. The process according to this embodiment is a process of selecting a frequency band establishing the wireless circuit between the base station and the mobile station, so that the interference electric power can be kept to a minimum upon connection of the call of the mobile station.

In FIG.3, the base station reads the information on the available frequency bands in its own cell/sector from the storage circuit 55 and informs the mobile station residing in the cell/sector covered by said base station of said information (step S11). The mobile station receives the information on the available frequency bands from the base station while still in waiting and stores this to the storage circuit 51 (step S12). Then, the mobile station reads the available frequency bands in its residing cell/sector from said storage circuit 51 and iteratively measures the total reception electric power of the frequency bands with the measuring circuit 53 (step S13).

Upon connection of a call, the mobile station notifies the base station of the latest measurements of the total reception electric power of every frequency band available in its residing cell/sector, measured in step S13 (step S14). The base station determines the frequency band establishing the wireless circuit between said base station and the mobile station, so as to keep the interference electric power to a minimum, based on the total reception electric power measurements of each of the uplink frequency bands measured at its own station and the total reception electric power measurements of each of the downlink frequency bands notified by the mobile station in step S14 (step S15).

FIG.4 is a flow chart illustrating a process according to another embodiment of the present invention.

The process according to this embodiment is a selection process during the handoff of the mobile station wherein a frequency band establishing the wireless circuit between the handoff base station and the mobile station is selected, so that the interference electric power is kept to a minimum.

In FIG.4, the mobile station, upon determination of a handoff initiation, measures the total reception electric power of each available frequency band in the handoff cell/sector based on the information on the available frequency bands in the adjacent cells/sectors notified by the originating base station (step S21). Then, the mobile station notifies said measurement results to the handoff base station via the originating base station (step S22).

The handoff base station determines the frequency band of establishing the wireless circuit between said base station and the mobile station, based on the information on the total reception electric power measurements of each of the uplink frequency bands measured at its own station and the total reception electric power measurements of each of the frequency bands notified by the mobile station in step S22 so that the interference electric power is kept to a minimum (step S23).

FIG.5 is a flow chart illustrating a process according to another embodiment of the present invention. The process according to this embodiment is also a selection process during the handoff of the mobile station like the process shown in FIG.4 wherein a frequency band establishing the wireless circuit between the handoff base station and the mobile station is selected so that the interference electric power is kept to a minimum. However, in the present embodiment, the total reception electric power measurements of all the available frequency bands for each of the adjacent cells/sectors measured at the mobile station is notified to the base station before the initiation of the handoff process, thus enabling a smooth handoff process.

In FIG.5, the base station informs the mobile stations communicating within a cell/sector covered by the base station of the available frequency bands in each cell/sector for all the adjacent cells/sectors (step S31). The mobile station iteratively measures the total reception electric power of all the available frequency bands in each adjacent cell/sector for all the informed adjacent cells/sectors (step S33), and makes notification of the resulting measurements to the base station (step S33).

The base station, upon the mobile station's handoff initiation, notifies the handoff base station of the latest measurements of the total reception electric power of all the available frequency bands in said handoff base station (step S34). The handoff base station determines the frequency band establishing the wireless circuit between said handoff base station and the mobile station based on the total reception electric power measurements of each of the uplink frequency bands measured at its own station and the total reception electric power measurements of each of the frequency bands notified in step S34, so as to keep the interference electric power to a minimum (step 35).

Next, with reference to FIG.6, a description of a method of determining the frequency band establishing the wireless circuit between the base station and the mobile station based on the total reception electric power measurements of each of the uplink frequency bands and the total reception electric power of each of the downlink frequency bands, used in each of the above-described embodiments, is given.

FIG.6 shows frequencies F1, F2, and F3 for each of the uplink and downlink frequency bands on the horizontal axis and the measurement values of the total reception electric power on the vertical axis. Here it should be noted that the frequencies F1, F2, and F3 for each of the uplink and downlink frequency bands do not necessarily have the same frequency values, but are merely represented in pairs.

In FIG.6, three frequencies F1, F2, and F3 are shown each for the uplink and downlink frequency bands. One frequency band among these three is selected as the frequency band establishing the wireless circuit between the base station and the mobile station so that the interference electric power is kept to a minimum. As shown in the drawing, a predetermined value is set for the total reception electric power, and a frequency band with a total reception electric power above said predetermined value is excluded and will not be selected. Thus, in the drawing, frequency F2 will not be selected since its total reception electric power exceeds said predetermined value in the downlink frequency band.

Also, if there is a frequency band whose total reception electric power value is lowest for both the uplink and downlink frequency bands, this will be the ideal frequency band for the above selection. In FIG.6, there is no such frequency band; therefore, when the frequency band with the lowest total reception electric power value is different for each of the uplink and downlink frequency bands, the frequency band having the lowest total reception electric power value in the uplink frequency band is selected among the frequency bands whose total reception electric power values do not exceed a predetermined value for each of the uplink and downlink frequency bands.

The reason why the frequency band having the lowest total reception electric power in the uplink frequency band is selected is because the larger the interference electric power capacity, namely, the total reception electric power, the larger the transmission electric power is needed in order to obtain the required reception quality. Particularly, the increase in the uplink transmission electric power causes the fast consumption of the battery in the mobile station. Thus, to save the battery of the mobile station, the frequency band with the lowest total reception electric power for the uplink rather than the downlink frequency band should be selected.

In the example of FIG.6, the frequency F2 exceeds the predetermined value and is thus excluded from the options. Among the remaining frequencies F1 and F3, the frequency with the lower total reception electric power for the uplink frequency band is F3 and thus F3 is selected.

[Advantages of the Present Invention]

As described above, according to the present invention, the base station informs the mobile station of the available frequency bands in its own cell/sector and in all the adjacent cells/sectors, and the mobile station measures the desired wave reception level of the pilot channel for one frequency band among the available frequency bands for each and every cell/sector informed by the base station and appropriately determines its residing cell/sector or the transition of the cell/sector based on the above measurement results.

Also, according to the present invention, the base station informs the mobile station of the frequency bands available in its own cell/sector, and the mobile station iteratively measures the total reception electric power of said frequency bands available in the above cell/sector while still in waiting and notifies the base station of the latest measurements upon connection of the call, wherein the base station determines the frequency band establishing the wireless circuit between the mobile station using the total reception electric power measurements of each of the uplink frequency bands measured at its own station and the total reception electric power measurements of each of the downlink frequency bands notified by the mobile station. Thus, the total reception electric power for each and every frequency band can be measured and a frequency band with the minimum interference electric power can be selected without increasing the load of the mobile station.

Further, according to the present invention, the mobile station, upon determining the handoff initiation, measures the total reception electric power of each of the

available frequency bands in the handoff cell/sector based on the information on the available frequency bands in the adjacent cells/sectors notified by the originating base station and notifies the handoff base station of the above measurement results, and the handoff base station determines the frequency band of the wireless circuit based on the total reception electric power measurements of each of the uplink frequency bands measured at its own station and said notified total reception electric power measurements of each of the frequency bands so that the total reception electric power for every frequency band can be measured and a frequency band with the minimum interference electric power can be selected without increasing the load of the mobile station.

According to the present invention, the base station informs the mobile station of the available frequency bands of the adjacent cells/sectors, and the mobile station iteratively measures the total reception electric power of the informed frequency bands and gives notification of the resulting measurements to the base station, wherein the mobile station notifies the handoff base station of the latest total reception electric power measurements of all the available frequency bands in the handoff base station upon the initiation of the handoff process of the mobile station, and the handoff base station determines the frequency band of the wireless circuit based on the total reception electric power measurements of each of the uplink frequency bands measured at its own station and said notified total reception electric power measurements of each of the frequency bands so that the total reception electric power for every frequency band can be measured and a frequency band with the minimum interference electric power can be selected without increasing the load of the mobile station.

Also, according to the present invention, a frequency band having the lowest total reception electric power in both the uplink and downlink frequency bands is selected

as the frequency band establishing the wireless circuit if such frequency band exists, or otherwise, a frequency band having the lowest total reception electric power for the uplink frequency band among the frequency bands whose total reception electric power measurement values are within a predetermined value for both the uplink and downlink frequency bands is selected so that the frequency band with the minimum interference electric power is selected, thus saving the battery of the mobile station.

[Brief Description of the Drawings]

FIG.1 is a block diagram showing the structure of the base station that performs the cell/sector determination and frequency selection method in a CDMA mobile communication system in accordance with an embodiment of the present invention;

FIG.2 is a block diagram showing the structure of the mobile station that performs the cell/sector determination and frequency selection method along with the base station in FIG.1 in a CDMA mobile communication system in accordance with an embodiment of the present invention;

FIG.3 is a flow chart showing a process of the present invention according to another embodiment;

FIG.4 is a flow chart showing a process of the present invention according to an alternative embodiment;

FIG.5 is a flow chart showing a process of the present invention according to a further alternative embodiment; and,

FIG.6 is a graph diagram showing the uplink and downlink frequency bands on the horizontal axis and the total reception electric power measurement values on the vertical axis for illustrating the method of determining the frequency band that establishes the wireless circuit between the base station and the mobile station based on the total reception electric power measurements of each of the uplink frequency bands and the total reception electric power measurements of each of the downlink frequency bands,

said method being used in each of the above embodiments.

[Description of Reference Symbols]

11 Control circuit of mobile station
31 Control circuit of base station
51 Storage circuit of mobile station
53 Measuring circuit of mobile station
55 Storage circuit of base station
57 Measuring circuit of base station

[Drawings]

FIG.1

21 Antenna
23 Transmission/reception distribution circuit
25 Reception circuit
27 Demodulation circuit
29 Decoding circuit
31 Control circuit
33 Encoding circuit
35 Modulation circuit
37 Transmission circuit
39 Cable transmission circuit
41 Cable transmission circuit
55 Storage circuit
57 Measuring circuit
To the switching station

FIG.2

1 Antenna
3 Transmission/reception distribution circuit
5 Reception circuit
7 Demodulation circuit
9 Decoding circuit
11 Control circuit
13 Encoding circuit
15 Modulation circuit
17 Transmission circuit

51 Storage circuit

53 Measuring circuit

To the man-machine interface

FIG.3

Start

S11 The base station informs the mobile station of the available frequency bands in its own cell/sectors

S12 The mobile station receives the information while waiting to be connected

S13 The mobile station measures the total reception electric power of the available frequency bands within its residing cell/sector

S14 The mobile station notifies the base station of the latest total reception electric power measurements of the available frequency bands within its residing cell/sector upon the connection of the call

S15 The base station determines the frequency band of the wireless circuit which is established between the mobile station based on the total reception electric power measurements of each of the uplink frequency bands measured at its own station and the total reception electric power measurements of each of the downlink frequency bands notified by the mobile station

End

FIG.4

Start

S21 The mobile station measures the total reception electric power of each of the available frequency bands in the handoff cell/sector based on the information on the available frequency bands in the adjacent cells/sectors informed by the originating base station upon determination of the handoff initiation

S22 The mobile station notifies the handoff base station of said measurement results via the originating base station

S23 The handoff base station determines the frequency

band that establishes the wireless circuit based on the total reception electric power measurements of each of the uplink frequency bands measured at its own station and the total reception electric power measurements of each of the frequency bands notified by the mobile station
End

FIG.5

Start
S31 The base station informs the mobile station of the available frequency bands in each cell/sector for all the adjacent cells/sectors
S32 The mobile station iteratively measures the total reception electric power of all the available frequency bands in each adjacent cell/sector for all the informed adjacent cells/sectors
S33 The mobile station notifies the base station of said measurement results
S34 The base station notifies the handoff base station of the latest total reception electric measurements of all the available frequency bands in the handoff base station upon the initiation of the handoff of the mobile station
S35 The handoff base station determines the frequency band that establishes the wireless circuit based on the total reception electric power measurements of each of the uplink frequency bands measured at its own station and the notified total reception electric power measurements of each of the frequency bands
End

FIG.6

Total reception electric power
Predetermined value
Uplink
Downlink
Frequency